REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED

Prepared in accordance with DOD-STD-100 **Selected item drawing**

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Original date of drawing 7 February 1986	PREPARED BY Greg A. Pitz	**DEFENSE ELECTRONICS SUPPLY CENTER DAYTON, OHIO**
	CHECKED BY D. A. Dicenzo	**TITLE** MICROCIRCUIT, DIGITAL, HIGH-SPEED CMOS, 8-INPUT, 3-STATE SELECTOR/MULTIPLEXER, MONOLITHIC SILICON
	APPROVED BY N. A. Hauck	
	SIZE A / **CODE IDENT. NO.** **14933**	**DWG NO.** **85125**
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DESC FORM 144
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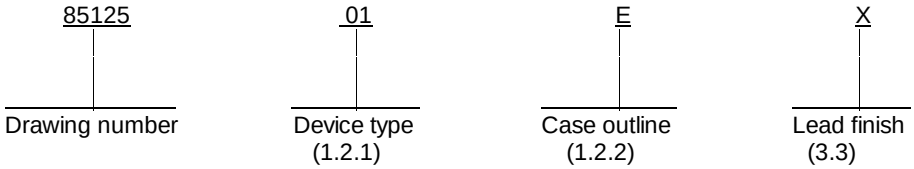
5962-E930

1. SCOPE

1.1 Scope. This drawing describes the requirements for monolithic silicon, high-speed CMOS, 3-state data selector/multiplexer microcircuits. This drawing provides a level of microcircuit quality and reliability assurance for acquisition of microcircuits in accordance with MIL-M-38510.

1.2 Part number. The complete part number shall be as shown in the following example:



1.2.1 Device type. The device type shall identify the circuit function as follows:

Device type	Generic number	Circuit
01	54HC251	8-input, 3-state Selector/Multiplexer

1.2.2 Case outlines. The case outlines shall be as designated in appendix C of MIL-M-38510, and as follows:

Outline letter	Case outline
E	D-2 (16-lead, 1/4" x 7/8"), dual-in-line package
F	F-5 (16-lead, 1/4" x 3/8"), flat package
2	C-2 (20-terminal, .350" x .350"), square chip carrier package

1.3 Absolute maximum ratings. 1/

Supply voltage range	-0.5 V dc to +7.0 V dc
DC input voltage	-0.5 V dc to V_{CC} +0.5 V dc
DC output voltage	-0.5 V dc to V_{CC} +0.5 V dc
Clamp diode current	±20 mA
DC output current (per pin)	±25 mA
DC V_{CC} or GND current (per pin)	±50 mA
Storage temperature range	-65°C to +150°C
Maximum power dissipation, P_D 2/	500 mW
Lead temperature (soldering 10 seconds)	260°C
Thermal resistance, junction-to-case (O_{JC}):	
Cases E and F	See MIL-M-38510, appendix C
Case 2	80°C/W 3/
Junction temperature (T_J)	175°C

1.4 Recommended operating conditions.

Supply voltage range (V_{CC})	+2.0 V dc to +6.0 V dc
Case operating temperature range (T_C)	-55°C to +125°C
Input rise or fall time:	
V_{CC} = 2.0 V	0 to 1000 ns
V_{CC} = 4.5 V	0 to 500 ns
V_{CC} = 6.0 V	0 to 400 ns

1/ Unless otherwise specified, all voltages are referenced to ground.
2/ For T_C = +100°C to +125°C, derate linearly at 12 mW/°C.
3/ When a thermal resistance for this case is published in MIL-M-38510, appendix C, that value shall supersede the value indicated herein.

2. APPLICABLE DOCUMENTS

2.1 Government specification and standard. The following specification and standard form a part of this drawing to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation.

SPECIFICATION

MILITARY

MIL-M-38510 - Microcircuits, General Specification for.

STANDARD

MILITARY

MIL-STD-883 - Test Methods and Procedures for Microelectronics.

(Copies of the specification and standard required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

3. REQUIREMENTS

3.1 Item requirements. The individual item requirements shall be in accordance with MIL-M-38510, and as specified herein. The country of manufacture requirement of MIL-M-38510 does not apply.

3.2 Design, construction, and physical dimensions. The design, construction, and physical dimensions shall be as specified in MIL-M-38510 and herein.

3.2.1 Design documentation. The design documentation shall be in accordance with MIL-M-38510 and, unless otherwise specified in the contract or purchase order, shall be retained by the manufacturer but be available for review by the acquiring activity or contractor upon request.

3.2.2 Terminal connections. The terminal connections shall be as specified on figure 1.

3.2.3 Truth tables. The truth tables shall be as specified on figure 2.

3.2.4 Logic diagram. The logic diagrams shall be as specified on figure 3.

3.2.5 Case outlines. The case outlines shall be in accordance with 1.2.2.

3.3 Lead material and finish. The lead material and finish shall be in accordance with MIL-M-38510.

3.4 Electrical performance characteristics. Unless otherwise specified, the electrical performance characteristics are as specified in table I and apply over the full recommended case operating temperature range.

3.5 Marking. Marking shall be in accordance with MIL-M-38510, except the part number shall be in accordance with 1.2 herein. The Vendor Similar Part Number may also be marked in accordance with 6.9 herein. Both part numbers, when used, shall be printed on the same surface. The "M38510/XXX " part number and the "JAN" or "J" mark shall not be used. Lead finish letter "X" is used only as specified in MIL-M-38510 and shall not be marked on the microcircuit or its packaging. The country of origin shall be marked on the microcircuit.

TABLE I. Electrical performance characteristics.

Test	Symbol	Conditions 1/ $-55°C \le T_C \le +125°C$		Group A subgroups	Limits		Unit
					Min	Max	
High-level output voltage	V_{OH}	$V_{IN} = V_{IH}$ or V_{IL} $\lvert I_O \rvert \le 20$ µA	$V_{CC} = 2.0$ V	1, 2, 3	1.9	---	V
			$V_{CC} = 4.5$ V		4.4	---	
			$V_{CC} = 6.0$ V		5.9	---	
		$\lvert I_O \rvert \le 4$ mA	$V_{CC} = 4.5$ V		3.7	---	
		$\lvert I_O \rvert \le 5.2$ mA	$V_{CC} = 6.0$ V		5.2	---	
Low-level output voltage	V_{OL}	$V_{IN} = V_{IH}$ or V_{IL} $\lvert I_O \rvert \le 20$ µA	$V_{CC} = 2.0$ V	1, 2, 3	---	0.1	V
			$V_{CC} = 4.5$ V		---	0.1	
			$V_{CC} = 6.0$ V		---	0.1	
		$\lvert I_O \rvert \le 4$ mA	$V_{CC} = 4.5$ V		---	0.4	
		$\lvert I_O \rvert \le 5.2$ mA	$V_{CC} = 6.0$ V		---	0.4	
High-level input voltage 2/	V_{IH}		$V_{CC} = 2.0$ V	1, 2, 3	1.5	---	V
			$V_{CC} = 4.5$ V		3.15	---	
			$V_{CC} = 6.0$ V		4.2	---	
Low-level input voltage 2/	V_{IL}		$V_{CC} = 2.0$ V	1, 2, 3	---	0.3	V
			$V_{CC} = 4.5$ V		---	0.9	
			$V_{CC} = 6.0$ V		---	1.2	

See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions 1/ $-55°C \le T_C \le +125°C$		Group A subgroups	Limits		Unit
					Min	Max	
Input capacitance	C_{IN}	V_{IN} = 0 V T_C = 25°C See 4.4.1(c)		4	---	10	pF
Quiescent current	I_{CC}	V_{CC} = 6.0 V_{IN} = V_{CC} or GND		1, 2, 3	---	160	µA
Input leakage current	I_{IN}	V_{IN} = 6.0 V V_{IN} = V_{CC} or GND		1, 2, 3	---	±1	µA
Off-state output current	I_{OZ}	V_O = V_{CC} or GND, V_I = V_{IH} or V_{IL}		1, 2, 3	---	±10	µA
Propagation delay A, B, or C to W or Y 3/	t_{PHL1} t_{PLH1}	T_C = 25°C C_L = 50 pF ±10%	V_{CC} = 2.0 V	9	---	205	ns
			V_{CC} = 4.5 V		---	41	
			V_{CC} = 6.0 V		---	35	
		T_C = -55°C +125°C C_L = 50 pF ±10%	V_{CC} = 2.0 V	10, 11	---	310	ns
			V_{CC} = 4.5 V		---	62	
			V_{CC} = 6.0 V		---	53	
Propagation delay Any D to W or Y 3/	t_{PHL2} t_{PLH2}	T_C = 25°C C_L = 50 pF ±10%	V_{CC} = 2.0 V	9	---	195	ns
			V_{CC} = 4.5 V		---	39	
			V_{CC} = 6.0 V		---	33	
		T_C = -55°C +125°C C_L = 50 pF ±10%	V_{CC} = 2.0 V	10, 11	---	295	ns
			V_{CC} = 4.5 V		---	59	
			V_{CC} = 6.0 V		---	50	

See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions 1/ $-55°C \le T_C \le +125°C$		Group A subgroups	Limits		Unit
					Min	Max	
Propagation delay output enable from G to W or Y 3/	t_{PZH} t_{PZL}	$T_C = 25°C$	$V_{CC} = 2.0$ V	9	---	175	ns
		$C_L = 50$ pF ±10%	$V_{CC} = 4.5$ V		---	35	
			$V_{CC} = 6.0$ V		---	30	
		$T_C = -55°C$ $+125°C$	$V_{CC} = 2.0$ V	10, 11	---	265	ns
		$C_L = 50$ pF ±10%	$V_{CC} = 4.5$ V		---	53	
			$V_{CC} = 6.0$ V		---	45	
Propagation delay output enable to W or Y (disable) 3/	t_{PHZ} t_{PLZ}	$T_C = 25°C$	$V_{CC} = 2.0$ V	9	---	220	ns
		$C_L = 50$ pF ±10%	$V_{CC} = 4.5$ V		---	44	
			$V_{CC} = 6.0$ V		---	37	
		$T_C = -55°C$ $+125°C$	$V_{CC} = 2.0$ V	10, 11	---	330	ns
		$C_L = 50$ pF ±10%	$V_{CC} = 4.5$ V		---	66	
			$V_{CC} = 6.0$ V		---	56	

See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions 1/ $-55°C \le T_C \le +125°C$		Group A subgroups	Limits		Unit
					Min	Max	
Transition time, high to low, low to high 4/	t_{THL} t_{TLH}	$T_C = 25°C$ $C_L = 50$ pF ±10%	$V_{CC} = 2.0$ V	9	---	75	ns
			$V_{CC} = 4.5$ V		---	15	
			$V_{CC} = 6.0$ V		---	13	
		$T_C = -55°C$ +125°C $C_L = 50$ pF ±10%	$V_{CC} = 2.0$ V	10, 11	---	110	ns
			$V_{CC} = 4.5$ V		---	22	
			$V_{CC} = 6.0$ V		---	19	

1/ For a power supply of 5 V ±10% the worst case output voltages (V_{OH} and V_{OL}) occur for HC at 4.5 V. Thus, the 4.5 values should be used when designing with this supply. Worst case V_{IH} and V_{IL}, occur at V_{CC} = 5.5 V and 4.5 V respectively. (The V_{IH} value at 5.5 V is 3.85 V.) The worst case leakage current (I_{IN}, I_{CC}, and I_{OZ}) occur for CMOS at the higher voltage and so the 6.0 V values should be used. Power dissipation capacitance (C_{PD}), typically 80 pF, determines the no load dyanamic power consumption, $P_D = C_{PD}\ V_{CC}\ 2f + I_{CC}\ V_{CC}$, and the no load dynamic current consumption, I_S = CPD V_{CC} f+I_{CC}.

2/ V_{IH} and V_{IL} tests not required if applied as a forcing function for V_{OH} and V_{OL}.

3/ AC testing at V_{CC} = 2.0 V and V_{CC} = 6.0 V shall be guaranteed, if not tested, to the specified parameters.

4/ Transition times if not tested shall be guaranteed to the specified parameters.

Device type 01

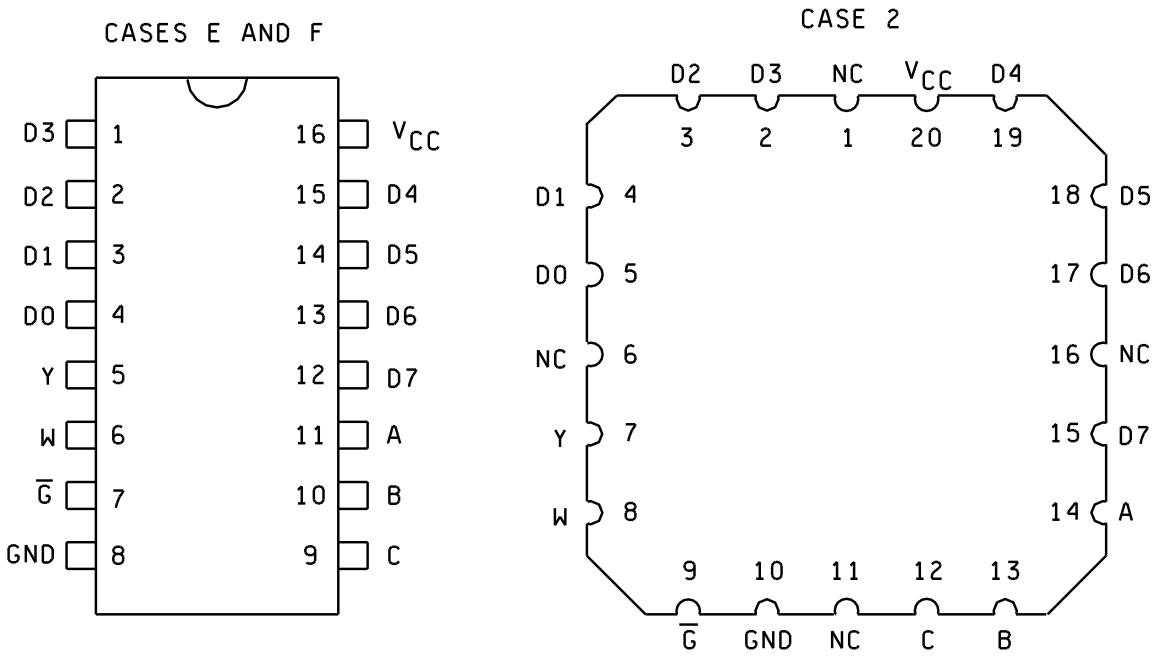


FIGURE 1. Terminal connections (top view).

Device type 01

INPUTS				OUTPUTS	
SELECT			STROBE		
C	B	A	$\overline{G}$	Y	W
X	X	X	H	Z	Z
L	L	L	L	D0	$\overline{D0}$
L	L	H	L	D1	$\overline{D1}$
L	H	L	L	D2	$\overline{D2}$
L	H	H	L	D3	$\overline{D3}$
H	L	L	L	D4	$\overline{D4}$
H	L	H	L	D5	$\overline{D5}$
H	H	L	L	D6	$\overline{D6}$
H	H	H	L	D7	$\overline{D7}$

FIGURE 2. Truth table.

Device type 01

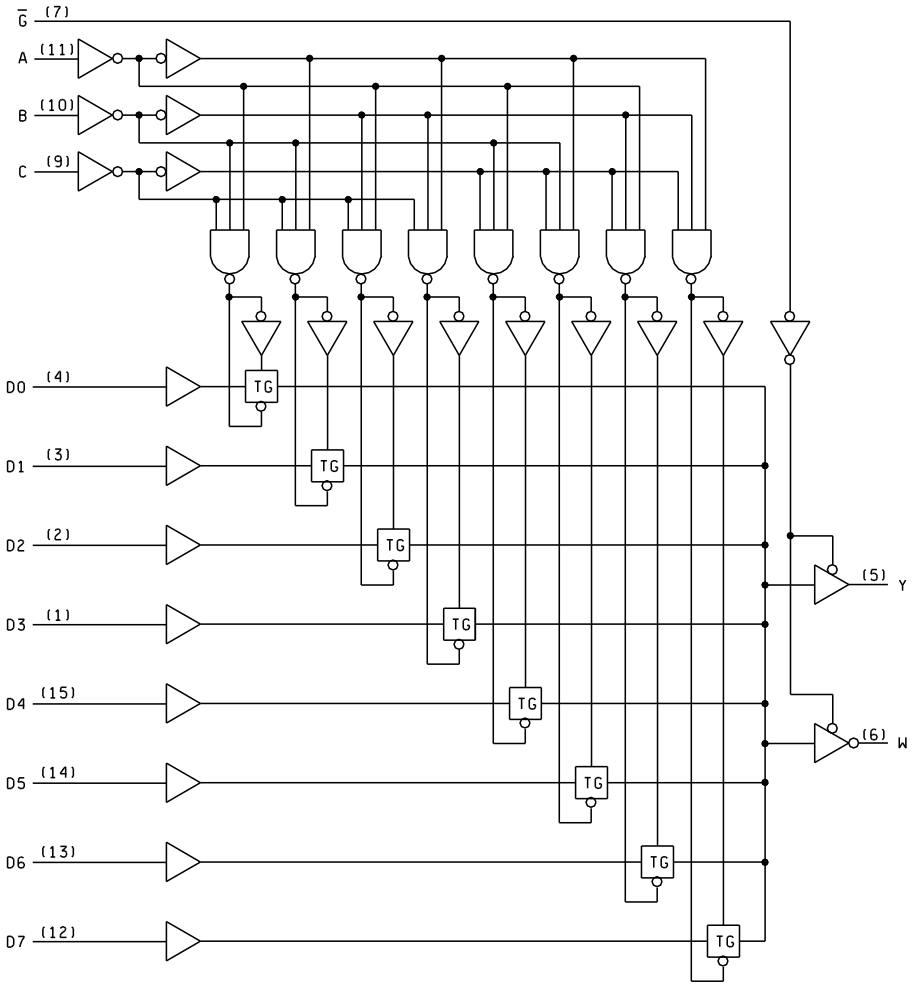


FIGURE 3. Logic diagram.

DEFENSE ELECTRONICS SUPPLY CENTER DAYTON, OHIO	SIZE A	CODE IDENT. NO. 14933	DWG NO. 85125
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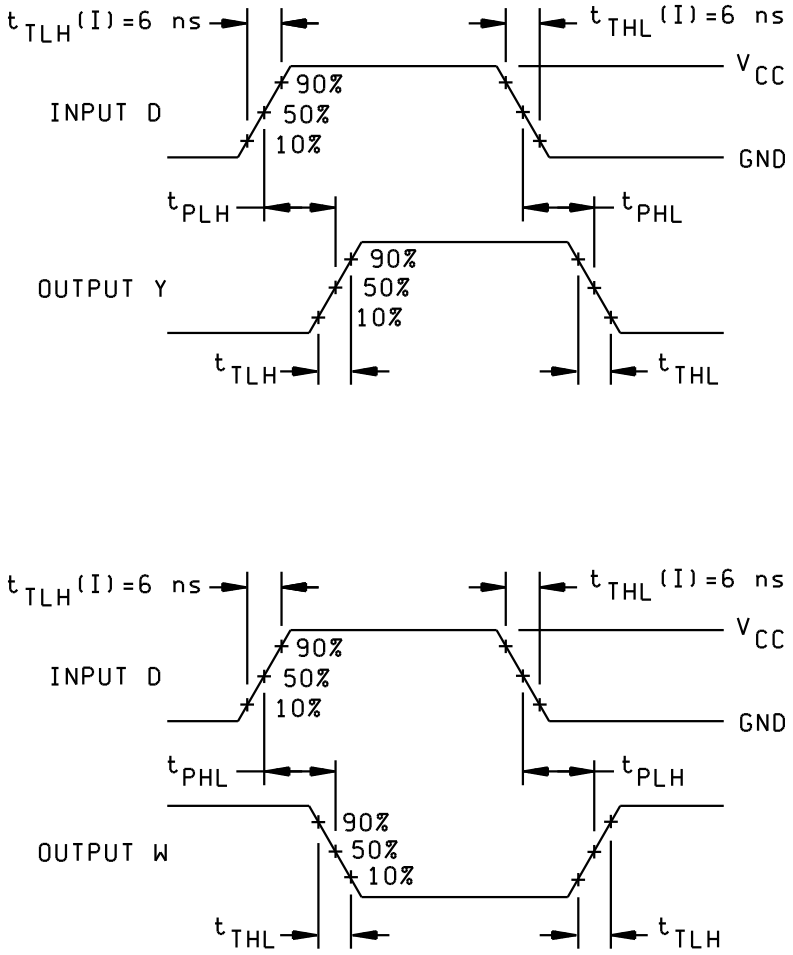

FIGURE 4. Switching time waveforms.

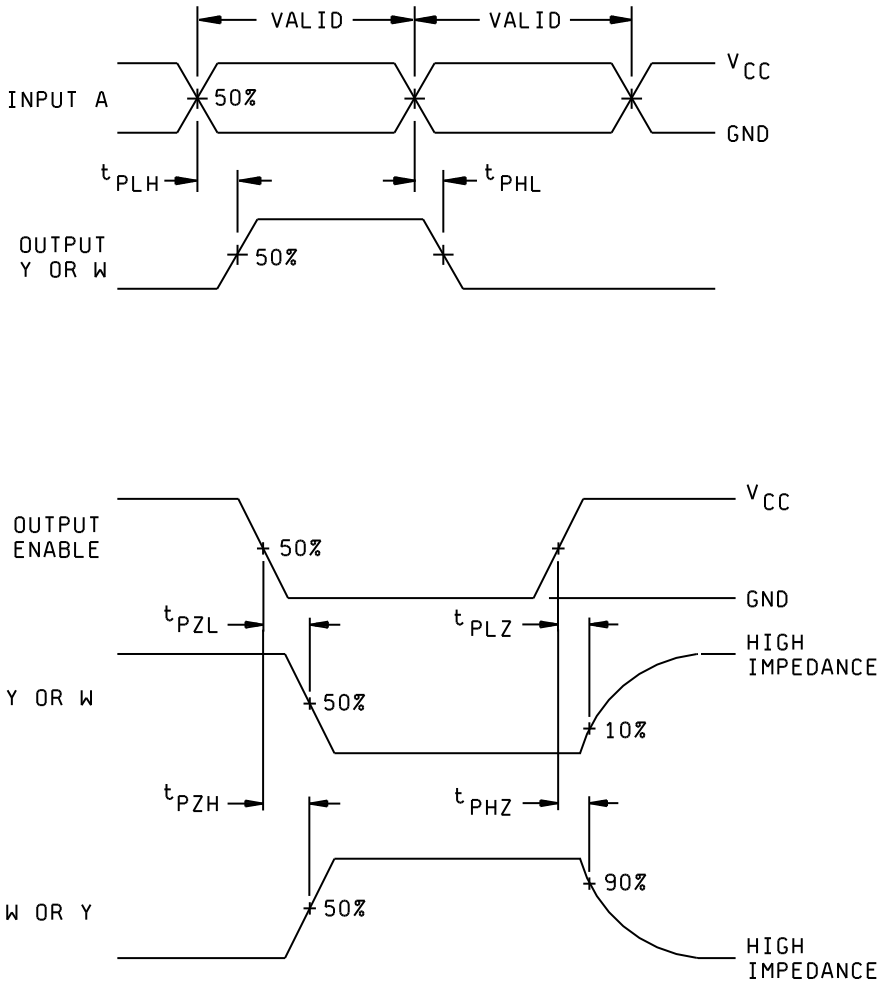

FIGURE 4. Switching time waveforms - Continued.

3.6 Quality assurance requirements. Microcircuits furnished under this drawing shall have been subjected to, and passed all the requirements, tests, and inspections detailed herein including screening and quality conformance inspections.

3.6.1 Screening. Screening shall be in accordance with method 5004, class B of MIL-STD-883 and 4.2 herein.

3.6.2 Qualification. Qualification inspection for the device type specified herein shall not be required.

3.6.3 Quality conformance inspection. Quality conformance inspection shall be in accordance with MIL-M-38510 and 4.4 herein.

3.7 Manufacturer eligibility. To be eligible to supply microcircuits to this drawing, a manufacturer shall have manufacturer certification in accordance with MIL-M-38510 for at least one line and have part I listing on Qualified Products List QPL-38510 for at least one device type (not necessarily the one for which the acquisition of this drawing is to apply).

3.8 Certificate of compliance. A certificate of compliance shall be required from a manufacturer in order to be listed as an approved source of supply (see 6.8 and 6.9).

4. QUALITY ASSURANCE PROVISIONS

4.1 Sampling and inspection. Sampling and inspection procedures shall be in accordance with MIL-M-38510 and method 5005 of MIL-STD-883, except as modified herein.

4.2 Screening. Screening shall be in accordance with method 5004 of MIL-STD-883, and shall be conducted on all devices prior to quality conformance inspection. The following additional criteria shall apply:

a. Burn-in test (method 1015 of MIL-STD-883).

(1) Test condition A, B, C, or D.

(2) T_A = +125° C, minimum.

b. Initial and final electrical test parameters shall be as specified in table II herein, except initial electrical parameter tests prior to burn-in are optional at the discretion of the manufacturer.

c. The percent defective allowable (PDA) shall be as specified in MIL-M-38510.

4.3 Qualification inspection. Qualification inspection for the device type specified herein shall not be required.

4.4 Quality conformance inspection. Quality conformance inspection shall be in accordance with MIL-M-38510 and method 5005 of MIL-STD-883. Groups A and B inspections shall be performed on each inspection lot or as specified in method 5005 of MIL-STD-883. Groups C and D shall be performed on a periodic basis in accordance with MIL-M-38510. Generic test data (see 6.5) may be used to satisfy the requirements for groups C and D inspections. Manufacturers shall keep lot records for 5 years (minimum), monitor for compliance to the prescribed procedures, and observe that satisfactory manufacturing conditions and records on lots are maintained for these devices. The records, including an attributes summary of all screening and quality conformance inspections conducted on each lot shall be available for review by customers at all times.

TABLE II. Electrical test requirements.

MIL-STD-883 test requirements	Subgroups (per method 5005, table I)
Initial electrical parameters (pre burn-in) (method 5004)	---
Final electrical test parameters (method 5004)	1*, 2, 9
Group A test requirements (method 5005)	1, 2, 3, 4, 7 9, 10**, 11**
Groups C and D end-point electrical parameters (method 5005)	1, 2, 3
Additional electrical subgroups for group C periodic inspections	

* PDA applies to subgroup 1 (see 4.2c).
** Subgroups 10 and 11, if not tested, shall be guaranteed to the specified limits in table I.

4.4.1 Group A inspection. Group A inspection shall consist of the test subgroups and LTPD values shown in table I of method 5005 of MIL-STD-883, class B, and as follows:

a. Tests shall be as specified in table II herein.

b. Subgroups 5, 6, and 8 in table I, method 5005 of MIL-STD-883 shall be omitted.

c. Subgroup 4 (C_{IN} measurement) shall be measured only for the initial test and after process or design changes which may affect input capacitance. Generic test data (see 6.5) may be used to satisfy subgroup 4 requirement.

d. Subgroup 7 tests sufficient to verify truth table.

4.4.2 Group B inspection. Group B inspection shall consist of the test subgroups and LTPD values shown in table IIb of method 5005 of MIL-STD-883, class B.

4.4.3 Groups C and D inspections. Groups C and D inspections shall consist of the test subgroups and LTPD values shown in tables III and IV, method 5005 of MIL-STD-883, class B, and as follows:

a. End-point electrical parameters shall be as specified in table II herein.

b. Steady-state life test (method 1005 of MIL-STD-883) conditions:

(1) Test condition A, B, C, or D.

(2) T_A = +125°C, minimum.

(3) Test duration: 1,000 hours, except as permitted by appendix B of MIL-M-38510 and method 1005 of MIL-STD-883.

5. PACKAGING

5.1 Packaging requirements. The requirements for packaging shall be in accordance with MIL-M-38510.

6. NOTES

6.1 Notes. Only the note "Reevaluation of lot quality" of the notes specified in MIL-M-38510 shall apply to this drawing.

6.2 Intended use. Microcircuits conforming to this drawing are intended for use when military specifications do not exist and qualified military devices that will perform the required function are not available for OEM application. This drawing is intended exclusively to prevent the proliferation of unnecessary duplicate specifications, drawings, and stock catalog listings. When a military specification exists and the product covered by this drawing has been qualified for listing on QPL-38510, this drawing will be inactivated and will not be used for new design. The QPL-38510 product shall be the preferred item for all applications.

6.3 Ordering data. The contract or purchase order should specify the following:

a. Complete part number (see 1.2).

b. Requirements for delivery of one copy of the quality conformance inspection data pertinent to the device inspection lot to be supplied with each shipment by the device manufacturer, if applicable.

c. Requirements for certificate of compliance, if applicable.

d. Requirements for notification of change of product or process to the contracting activity, if applicable.

e. Requirements for special carriers, lead lengths, or lead forming, if applicable. These requirements shall not affect the part number. Unless otherwise specified, these requirements will not apply to direct shipment to the Government.

6.4 Replaceability. Replaceability is determined as follows:

a. Microcircuits covered by this drawing will replace the same generic device covered by a contractor-prepared specification or drawing.

b. When a QPL source is established, the part numbered device specified in this drawing will be replaced by the microcircuit identified as part number M38510/66205B--.

6.5 Generic test data. Generic test data may be used to satisfy the requirements of 4.4.1c and 4.4.3. Group C generic test data shall be on date codes no more than 1 year old and on a die in the same microcircuit group (see appendix E of MIL-M-38510) with the same material, design, and process and from the same plant as the die represented. Group D generic data shall be on date codes no more than 1 year old and on the same package type (terms, definitions, and symbols of MIL-M-38510) and from the same plant as the package represented. The vendor is required to retain the generic data for a period of not less than 5 years from the date of shipment.

6.6 Comments. Comments on this drawing should be directed to DESC-ECS, Dayton, Ohio 45444, or telephone 513-296-5375.

6.7 Handling. MOS devices must be handled with certain precautions to avoid damage due to accumulation of static charge. Input protection devices have been designed in the chip to minimize the effect of this static buildup. However, the following handling practices are recommended:

a. Devices should be handled on benches with conductive and grounded surfaces.

b. Ground test equipment, tools, and operator.

c. Do not handle devices by the leads.

d Store devices in conductive foam or carriers.

e. Avoid use of plastic, rubber, or silk in MOS areas.

f. Maintain relative humidity above 50 percent, if practical.

6.8 Submission of certificate of compliance. The certificate of compliance submitted to DESC-ECS, prior to listing as an approved source of supply in 6.9, shall state that the manufacturer's product meets the requirements herein.

6.9 Approved source of supply. An approved source of supply is listed herein. Additional sources will be added as they become available. The vendor listed herein has agreed to this drawing and a certificate of compliance (see 3.8) has been submitted to DESC-ECS.

DESC drawing part number	Vendor FSCM number	Vendor similar part number	Replacement military specification part number
8512501EX	04713 01295 18714	54HC251/BEAJC SNJ54HC251J CD54HC251F/3A	M38510/66205BEX
8512501FX	01295	SNJ54HC251W	M38510/66205BFX
85125012X	01295 04713	SNJ54HC251FK 54HC251M/B2CJC	M38510/66205B2X

Vendor FSCM number	Vendor name and address
01295	Texas Instruments, Inc. P. O. Box 6448 Midland, TX 79701
04713	Motorola, Inc. 7402 S. Price Rd. Tempe, AZ 85283
18714	RCA Corp. Route 202 Somerville, NJ 08876
27014	National Semiconductor 2900 Semiconductor Dr Santa Clara, CA 95051